NSF NANOSCALE SCIENCE AND ENGINEERING GRANTEES CONFERENCE: NANOBIOLOGY
DECEMBER 7-8, 2023

BUILDING ARTIFICIAL RNA ORGANELLES VIA PHASE SEPARATION

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Abstract: The discovery of membrane-less cellular organelles is transforming our understanding of cellular biology. Because these organelles, also called biomolecular condensates, play key roles in regulation, stress and disease, there is intense interest toward developing artificial condensates that could be used manipulate and understand many cellular functions. I will present our recent work toward the rational design of artificial, multifunctional RNA condensates. The key component for generating condensates is a single RNA molecule that folds into a star-shaped motif, or nanostar. The interactions among multiple nanostars are programmed via kissing loops. We demonstrated that through sequence design of distinct nanostars we can produce orthogonal (distinct and immiscible) condensates, which can be individually tracked via fluorogenic aptamers. The inclusion of aptamers makes it possible to recruit peptides and proteins to the condensates with high specificity. We will discuss our cell-free characterization data, and preliminary data demonstrating that RNA nanostars can form artificial RNA organelles in mammalian cells.

Bio: Elisa Franco is a Professor in Mechanical & Aerospace Engineering and Bioengineering at UCLA. She received a Ph.D. in Control and Dynamical Systems from the California Institute of Technology, and a Ph.D. in Automation from the University of Trieste, Italy. The Franco group works on research problems at the intersection of DNA/RNA nanotechnology and mathematical modeling, with focus on design and synthesis of circuits and responsive materials using nucleic acids and proteins. These projects are funded by the NSF, the DOE, the Sloan Foundation, and the Broad Stem Cell Research Center at UCLA. Prof. Franco is the recipient of the NSF CAREER award, the Rose Hills Foundation Young Investigator award, and is a Hellman Fellow.